

COOS BAY SEDIMENT QUALITY EVALUATION REPORT

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ACRONYMS

EPA	Environmental Protection Agency
USACE	U.S. Army Corps of Engineers
Corps	U.S. Army Corps of Engineers
ODEQ	Oregon Department of Environmental Quality
DMEF	Dredge Material Evaluation Framework
NES	Newly Exposed Surface
QA/QC	Quality Assurance/Quality Control
MDL	Method Detection Limit
CoC	Contaminate of concern
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
MRL	Method Reporting Limit
TVS	Total Volatile Solids
ND	non-detect
pptr	parts per trillion – ng/kg
As	Arsenic
Cd	Cadmium
Ni	Nickel
Cu	Copper
Sb	Thallium
Pb	Lead
Hg	Mercury
Ni	Nickel
Ag	Silver
Zn	Zinc
GC	Gravity Core Sampler
BC	Boxcore Sampler
SL	Screening Level
ASTM	American Society for Testing and Materials
RMT	Regional (sediment) Management Team
DDT	Dichlorodiphenyltrichloroethane and breakdown products (DDE &DDD)
TBT	Tributyltin and other organotins
TOC	Total Organic Carbon

Note: This Coos Bay Sediment Quality Evaluation Report was reviewed by the Regional (sediment) Management Team (RMT) in accordance with the DMEF (1998). The RMT consists of Portland District Corps of Engineers, EPA and ODEQ personnel. All comments received have been incorporated into the report and was considered final at the end of the review period, April 28, 2005.



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ABSTRACT

Coos Bay is located about 200 miles south of the mouth of the Columbia River. It is the largest estuary, excepting the Columbia River estuary, in the state of Oregon. The bay is shaped like an upside down U (see map) with many side arms and extensions. There are about 30 tributaries, but the major one is the Coos River, which discharges to the bay at a point 14 miles from the estuary mouth. The channel across the outer bar (from deepwater to RM 0+40) is 47 feet deep and 700 feet wide. The size of the channel then gradually decreases to 37 feet deep and 300 feet wide at RM 0+40. These dimensions continue to RM 9.0, where it widens to 400 feet and continues to RM 15.0 (Isthmus Slough); it then decreases to 22 feet deep and 150 feet wide until RM 17.0. An access channel 17 feet deep and 150 feet wide runs from deep water in Coos Bay, at approximately RM 2 on the main Coos Bay channel, to the mooring basin at Charleston. The Charleston mooring basin is 17 feet deep, 500 feet wide, and 900 feet long. The south slough Channel Extension is 16 feet deep and 150 feet wide; it runs from the mooring basin to the Highway Bridge across the Slough at RM 1.3.

This evaluation was conducted following procedures set forth in the Ocean Testing Manual and Inland Testing Manual, developed jointly by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency to assess dredged material. Guidelines used are those developed to implement the Clean Water Act and Marine Protection, Research and Sanctuaries Act. These national guidelines and associated local screening levels are those adopted for use in the regional Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF), November 1998.

Seventeen (17) sediment samples were collected along the length of the federal channel in Coos bay, Isthmus Slough and Charleston Channel, on September 15, 2004. All samples were submitted for physical and chemical analyses, includes metals (9 inorganic), total organic carbon, pesticides, polychlorinated biphenyls (PCBs), chlorinated organic compounds, phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbon (PAHs) and total and pore water organotin (TBT).

The physical analyses resulted in mean values of 1.6% gravel (shell hash) (0%-10.0% range), 69.6% sand (4.0%-98.8% range), and 28.8% silt/clay (1.2%-96.0% range), with 4.5% volatile solids (0.2%-16.7% range).

The chemical analyses indicated only low levels of contamination in any of the samples, with all levels well below their respective DMEF screening levels, with the exception of several semi-volatile compounds, in which the lab was not able to reach sufficiently low detection levels. However, none of the phenols, chlorinated organic compounds or miscellaneous extractables or the pesticide chlordane has ever been detected above DMEF screening levels in previous studies at Coos Bay. Several pore water organotin (TBT) detection levels were also elevated, due to insufficient porewater in high sand (>95%) content samples. TBT levels have been of concern in Coos Bay, primarily in the fine-grained sediment areas of Isthmus Slough; all sample with greater than 10% fines (<230 sieve) had sufficient pore water available and the lab was able to achieve detection levels below the DMEF



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SL of 0.15 ug/L. In addition bulk whole sediment TBT was run with results well below levels of concern (non-detect at <1.3 ug/kg) for samples where sufficient pore water was not available.

Using the data collected in this and numerous previous sampling events, the material represented by all samples in this sampling event is determined to be suitable for unconfined, in-water placement, without further characterization.

INTRODUCTION

The sampling and analysis objectives are stated in the Sampling and Analysis Plan (SAP August 2004), and are, also, listed below. This report will characterize the sediment of the federal channel in Coos bay, Isthmus Slough and Charleston Channel.

Sampling and Analysis Objectives

Characterize sediments in accordance with the regional dredge material-testing manual, the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF).

- A gravity-core sampler will be used to collect the fine-grained material from Isthmus Slough. A box-core sampler will be used to collect all other areas, where material to be collected is primarily sand.
- Collect, handle and analyze representative sediment of the purposed dredging prism, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.
- Characterize sediments to be dredged for evaluation of environmental impact.
- Conduct physical and chemical characterization only, for this sediment evaluation, unless further characterization is required.

PREVIOUS STUDIES

Coos Bay has had extensive sediment evaluation sampling events. The following historical events include samples collected for operation and maintenance (O&M) channel deepening, TBT studies and permit dredging.

Corps Sampling Events:

1980 September - Sediments were subjected to elutriate and bulk chemical, benthic and physical analyses from the Coos River navigation channel at river mile (RM) 0.0 of its main stem and RM 7.5 on South Fork Coos River. Water from the same locations was collected for use in performing tests and was chemically analyzed for comparison with the sediment elutriates data.

1986 May - Sediment samples (3) from Isthmus Slough were collected using a vibra-corer and subjected to physical analyses.

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1987 September - Sediment samples (3) were collected from Isthmus Slough at the same locations sampled in May 1986 using a gravity corer. Sediment samples were subjected to bulk chemical and physical analyses. The bulk chemistry included TOC, metal, PAH and pesticide/PCB analysis. No PAHs or pesticides/PCBs were detected, all metals were below concern levels and the material to be dredged was determined to be suitable for unconfined in-water disposal.

1989 June - Sediment samples were collected from 21 stations from RM 0.0 to RM 15 along the main Coos Bay Federal Channel Deepening Reconnaissance Study. All Samples were subjected to physical analyses while the finer grained sediments collected above RM 10.5 were also analyzed for bulk chemistry. The bulk chemical analyses included TOC, metals, PAHs and pesticide/PCBs. All the material to be dredged was determined to be suitable for unconfined in-water disposal.

1993 April - Sediment samples were collected and analyzed from the main federal navigational channel, a proposed expansion of the RM 12 turning basin, and various locations along the sides of the main channel. These samples were collected and analyzed for three purposes: 1. Sediment quality evaluation of the Isthmus Slough sediments, 2. Sediment quality evaluation of the material to be removed by expanding the RM 12 turning basin as part of the proposed channel deepening, and 3. Project wide TBT evaluation. All project sediments were found to be suitable for unconfined in-water disposal.

1994 July - Sediment samples (10) were collected along two transects and evaluated for metal and TBT contamination to satisfy questions raised by Oregon's DEQ. DEQ had information on TBT and metal contamination at Hilstrom Marine (RM 13+40) and Mid-coast Marine (RM 15) in the Isthmus Slough Area of the bay. DEQ was concerned that deepening the channel would cause slumping of contaminated material into the channel. At Hilstrom the analyses showed that the TBT contamination dropped dramatically towards the channel. At Mid-coast marine contamination was not as high, but mid-channel sediments were found to contain 150ppb TBT. This was above the bulk sediment screening level of 30 ppb used by EPA, Region 10. Additional evaluation (biological) would be needed prior to the estimated 1200 cy of dredging material at the upper end of the federal project.

1995 May - Three sediment samples were collected from the Federal Channel in the area of TBT contaminated sediment identified in July 1994 (RM 15) for physical, chemical and biological evaluations. Chemical testing included analyses for butyltin (TBT) and PAHs. Two bioassays, the 10 day amphipod *Rhepoxynius abronius* and 48 hour oyster larval *Crassostrea gigas*, were conducted along with a 28 day benthic worm *Nephtys caecoids* bioaccumulation study. Based upon the chemistry and the bioassay results, the material from the Federal Channel was determined to be suitable for unconfined in-water disposal. Of particular concern in Coos Bay is the presence of TBT in some areas associated with past marine boat repair. DEQ's apparent main concern is that dredging operations are resuspending TBT contaminated sediments and thereby shellfish are being contaminated. After extended discussions with various persons at DEQ the 1,200 cubic yards of material in question was dredged and placed in ODMDS H with the previous 600,000 cubic yards dredged from Isthmus Slough in 1995.

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1998 August – Sixteen sediment samples were collected in Coos Bay and Isthmus Slough, August 11-12, 1998. All 16 samples were sent to Sound Analytical Services, Inc. laboratory in Tacoma, WA, for physical analyses. Eleven samples were selected for the following chemical analyses: metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), phenols, phthalates, chlorinated organic compounds, miscellaneous extractables, and polynuclear aromatic hydrocarbons (PAH). Nine stations were sampled for tributyltin (TBT). The median grain size for all sediment was 0.18mm, with 29.2% fines. No chemicals of concern were detected above the established screening level (SL).

Other Sampling Events and studies (includes joint-Corps and non-Corps projects):

1991 – 1997 Oregon International Port of Coos Bay and Dock Owner Permittees studies have submitted a total of 70 samples for various analyses including a TBT study.

1992 – DEQ on several dates collected 19 (includes QA/QC) samples throughout the Bay for TBT analysis.

1993 – DEQ submits 35 samples (includes QA/QC splits) to different labs for TBT analysis.

1993 – DEQ collected 2 samples from Marshfield Channel Dredge Placement Area.

1993 – A joint effort by COE, EPA, DEQ collected 16 (includes QA/QC) samples which were submitted for TBT analysis.

1994 – COE & DEQ shipped samples to different labs as part of the Channel Deepening Study submitting a total of 17 (includes QA/QC) samples for analysis (TBT, metals, AVS and TOC and Bioassay).

1995 – A joint TBT study by COE & EPA analyzed 17 (includes QA/QC) samples.

1996 – Roy F. Weston, Inc. assessed TBT concentrations at 4 locations in Coos Bay for an EPA sponsored study requested by DEQ. Fifteen (15) sediment samples were collected throughout the bay, with no petroleum hydrocarbon (oil) detected.

TBT tissue concentration analyses of various fish and shellfish were conducted by DEQ from 1992 – 1994 at various sites throughout Coos Bay and its surrounding sloughs and inlets.

Bioaccumulation results showed 87.3% of the tissues were non-detect for TBT. Those that showed levels of TBT were less than (<) 2mg TBT/kg body weight (dry). Chronic effects levels for species of concern typically fall within a range of 2-12 mg TBT/kg body weight, with a median value of about 4 ppm (literature cited in the DMEF, page 8A-6).

1998 - This round of TBT sampling was initiated as an ongoing response to concerns by DEQ that deepening of the channel would cause “slumping” of contaminated material into the channel. The sampling for TBT was designed to target the sights of concern. A cross-section sampling of the Federal Channel (mid-channel and near-shore) was taken at both major sites of concern (Mid-Coast-RM 13+40 and Hilstrom-RM 15). A total of 9 stations were sampled and submitted for TBT. Only 2 (both at Hilstrom) of the 9 stations indicated the presence of a butyltin compound (monobutyltin). The level of the highest concentration of monobutyltin was 43.3% of the SL. All material was acceptable for unconfined open water disposal.

1999 - With the oil release, following the grounding and breakup of the ship New Crissia, testing was done for physical properties and total petroleum hydrocarbon, with hydrocarbon identification (TPH-HCID).

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The Corp of Engineers regularly monitors sediment quality within Coos Bay navigational channel prior to dredging and disposal operations to insure compliance with all Federal and State regulations and guidelines for unconfined in-water disposal. All material discharged in open water has met criteria under these regulations and guidelines.

CURRENT SAMPLING EVENT/DISCUSSION

A total of seventeen (17) sediment sampling stations, were collected along the length of the Federal Navigational Channel at Coos Bay, Charleston Harbor and Isthmus Slough, on September 15, 2004. Thirteen (13) boxcore (BC) samples were taken along with four (4) gravity-core (GC) samples (see figure 2). All samples were submitted for physical analyses including total volatile solids and were, also, analyzed for metals (9 inorganic), total organic carbon, pesticides, polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables and polynuclear aromatic hydrocarbon and organotin (TBT).

Laboratory detection levels (MDLs) were above their corresponding DMEF screening levels (SL) for some samples; these include the following: 1 pesticide (Chlordane), 2 phenols (2-Methyl phenol & 2,4-Dimethylphenol), 3 chlorinated organic compounds (1,2 Dichlorobenzene, 1,2,4-Trichlorobenzene & Hexachlorobenzene) and 3 miscellaneous extractables (Benzyl alcohol, Hexachlorobutadiene & N-Nitrosodiphenylamine). None of these compounds have been detected above DMEF screening levels in previous sampling events.

**Table 1. Sample Location Coordinates
(NAD 83, Oregon State Plane South)**

0915CB-GC-01	43°21'44.9"	0915CB-GC-02	43°21'41.6"
	124°11'59.6"		124°12'14.2"
0915CB-GC-03	43°22'04.9"	0915CB-GC-04	43°23'33.8"
	124°12'41.2"		124°13'02.4"
0915CB-BC-05	43°23'33.8"	0915CB-BC-06	43°24'28.4"
	124°13'02.4"		124°13'07.0"
0915CB-BC-07	43°25'15.4"	0915CB-BC-08	43°25'41.0"
	124°12'59.1"		124°14'01.1"
0915CB-BC-09	43°25'26.7"	0915CB-BC-10	43°25'19.1"
	124°14'49.5"		124°16'05.9"
0915CB-BC-11	43°24'02.5"	0915CB-BC-12	43°22'59.9"
	124°16'54.0"		124°17'32.5"
0915CB-BC-13	43°21'53.2"	0915CB-BC-14	43°21'05.5"
	124°18'56.3"		124°19'47.9"
0915CB-BC-15	43°21'23.1"	0915CB-BC-16	43°20'50.0"
	124°20'34.3"		124°19'12.0"
0915CB-BC-17	43°20'45.0"		
	124°19'12.5"		

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RESULTS

Physical and Volatile Solids (ASTM methods)

Seventeen (17) samples were submitted for physical and TVS analyses; the data are presented in Table 2. Nine (9) samples were classified as “poorly graded sand,” 3 as elastic silt, 2 as elastic silt with sand, 2 as “poorly graded sand with silt,” and one sample was classified as “silty sand”. As expected, the finer grained material was collected from the lower east bay and into Isthmus Slough. The physical analyses resulted in mean values of 1.6% gravel (0%-10.0% range), 69.6% sand (4.0%-98.8% range), and 28.8% silt/clay (1.2%-96.0% range), with 4.5% volatile solids (0.2%-16.7% range).

Metals (EPA method 6020/7471), Total Organic Carbon (EPA method 9060)

Seventeen (17) samples were submitted for testing, with data presented in Table 3. The TOC ranged from <500 to 36,000 mg/kg in the samples.

Low levels of most metals tested were found in all samples, but no levels approach their respective DMEF SL and are consistent with historical data levels at Coos Bay.

Pesticides/PCBs (EPA method 8081A/8082), Phenols, Phthalates, chlorinated organic compounds and Miscellaneous Extractables (EPA method 8270)

Seventeen (17) samples were submitted for testing, with data presented in Table 4. No PCB Aroclors or total DDT was detected in any of the samples. Although not detected (ND) in any samples, some of the laboratory Method Detection Levels (2004 data MDLs ranged 9.9 to 22.8 ug/kg) for Chlordane were elevated and exceeded the DMEF SL of 10 ug/kg. Chlordane has not historically been detected in Coos Bay sediment, with data MDLs sufficiently below DMEF SLs (1998 data MDLs ranged from 2.6 to 4.7 ug/kg). Two (2) phenol and three (3) phthalate compounds were detected in the fine-grained material collected from within Isthmus Slough and the turning basin at river mile (RM) 12; however all levels detected were less than the PQL, were considered estimates and did not approach their corresponding DMEF SL. Semi-volatile detection levels were sufficiently low enough to evaluate material, with the exception of 2 phenols, 3 misc. extractables and 3 chlorinated organic compounds; while none of these compounds were detected, these compounds had elevated detection levels in some samples. Historical sample analyses have never detected any of these compounds, with detection limits below DMEF SLs; therefore the weight of evidence indicates these compounds are not present at levels of concern in Coos Bay sediment.

Organotin (Total (Bulk sediment) & Pore-Water - Krone methods)

Seventeen (17) samples were submitted for testing, with data presented in Table 5. No organotin was detected in either the whole sediment (bulk) or the pore water samples submitted. Four (4) of the pore water analysis had elevated detection levels, all >95% sand. Due to its compacting structure,



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sand does not hold water between particles like finer grained material. However, with the added whole sediment value for organotin it is possible to determine that no organotin is present at the detection limits (see table 5).

Polynuclear Aromatic Hydrocarbons (EPA method 8270C)

Seventeen (17) samples were submitted for testing, with data presented in Table 6. Several “low molecular weight” and “High molecular weight” PAHs were detected in the fine-grained material collected from within Isthmus Slough and the turning basin at river mile (RM) 12; however all levels detected were less than the PQL, were considered estimates and did not approach their corresponding DMEF SL.

CONCLUSION

This evaluation was conducted following procedures set forth in the Ocean Testing Manual and Inland Testing Manual, developed jointly by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency to assess dredged material. Guidelines used are those developed to implement the Clean Water Act and Marine Protection, Research and Sanctuaries Act. These national guidelines and associated local screening levels are those adopted for use in the regional Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF), November 1998.

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The physical analyses resulted in mean values of 1.6% gravel (0%-10.0% range), 69.6% sand (4.0%-98.8% range), and 28.8% silt/clay (1.2%-96.0% range), with 4.5% volatile solids (0.2%-16.7% range).

The chemical analyses indicated only low levels of contamination in any of the samples, with all levels well below their respective DMEF screening levels, with the exception of several semi-volatile compounds, in which the lab was not able to reach sufficiently low detection levels. However, none of the phenols, chlorinated organic compounds or miscellaneous extractables or the pesticide chlordane has ever been detected above DMEF screening levels in previous studies at Coos Bay. Several pore water organotin (TBT) detection levels were also elevated, due to insufficient porewater in high sand (>95%) content samples. TBT levels have been of concern in Coos Bay, primarily in the fine-grained sediment areas of Isthmus Slough; all sample with greater than 10% fines (<230 sieve) had sufficient pore water available and the lab was able to achieve detection levels below the DMEF SL of 0.15 ug/L. In addition bulk whole sediment TBT was run with results well below levels of concern (non-detect at <1.3 ug/kg) for samples where sufficient pore water was not available.



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Using the data collected in this and numerous previous sampling events, the material represented by all samples in this sampling event is determined to be suitable for unconfined, in-water placement, without further characterization.



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1.

Table 2: Physical Analysis and Volatile Solids

Sample I.D.	Grain Size (mm)	Percent			
	Mean	Gravel	Sand	Silt/Clay	Volatile Solids
0915CB-GC-01	0.043	0.0	13.6	86.4	13.2
0915CB-GC-02	0.041	0.0	5.4	94.6	10.3
0915CB-GC-03	0.040	0.0	4.0	96.0	8.6
0915CB-GC-04	0.049	0.7	23.4	75.9	16.7
0915CB-BC-05	0.047	0.0	19.1	80.9	7.1
0915CB-BC-06	0.196	4.6	80.9	13.5	1.0
0915CB-BC-07	0.252	10.0	80.0	10.0	15.7
0915CB-BC-08	0.244	0.1	97.6	2.3	0.5
0915CB-BC-09	0.305	8.0	88.6	3.4	0.6
0915CB-BC-10	0.306	0.4	92.9	6.7	0.2
0915CB-BC-11	0.308	0.0	97.7	2.3	0.2
0915CB-BC-12	0.408	2.0	94.4	3.6	0.7
0915CB-BC-13	0.349	0.4	96.3	3.3	0.3
0915CB-BC-14	0.271	0.4	97.6	2.0	0.5
0915CB-BC-15	0.338	0.0	98.8	1.2	0.7
0915CB-BC-16	0.295	0.0	95.3	4.7	0.5
0915CB-BC-17	0.310	0.0	96.9	3.1	0.4
Mean	0.2236	1.6	69.6	28.8	4.5
Minimum	0.040	0.0	4.0	1.2	0.2
Maximum	0.408	10.0	98.8	96.0	16.7

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Table 3: Inorganic Metals and TOC

Sample I.D.	As	Sb	Cd	Cu	Pb	Ni	Ag	Zn	Hg	TOC
	mg/kg (ppm)									
0915CB-GC-01	11.6	<1.28	1.26 J	32.4	12.9	36.9	1.67 J	86.5	0.080	36000
0915CB-GC-02	12.0	<1.22	1.12 J	32.4	12.7	37.9	1.72 J	87.9	0.110	34000
0915CB-GC-03	7.89	1.95 J	0.998 J	26.9	11.3	34.4	1.47 J	81.0	<0.080	27000
0915CB-GC-04	11.3	<2.6	1.48 J	27.5	13.4	31.4	2.13	74.3	<0.060	29000
0915CB-BC-05	7.57	1.12 J	0.892 J	19.6	8.64	29.2	1.21 J	64.4	<0.080	24000
0915CB-BC-06	3.78	<0.61	0.257 J	8.83	3.31	8.46	0.419	20.5	<0.040	3500
0915CB-BC-07	4.65	<0.60	0.204 J	2.74 J	2.35	7.10	<0.60	16.5	<0.04	2800
0915CB-BC-08	3.61	<0.57	0.114 J	1.80 J	2.24	3.50 J	<0.57	11.2	<0.04	540
0915CB-BC-09	4.48	0.654 J	0.156 J	<0.27	1.42	4.61	<0.55	10.7	<0.04	1800
0915CB-BC-10	4.25	0.999 J	0.124 J	2.41 J	1.35	3.79 J	<0.61	11.3	<0.04	630
0915CB-BC-11	4.52	<0.61	<0.222	2.55 J	1.48	3.49 J	<0.61	9.72	<0.04	<500
0915CB-BC-12	12.1	<0.51	0.155 J	0.868 J	3.08	3.50 J	<0.51	11.1	<0.04	530
0915CB-BC-13	4.86 J	<0.59	0.133 J	1.97 J	1.31 J	3.42 J	<0.440	10.6	<0.04	<500
0915CB-BC-14	5.65	<0.54	0.184 J	2.48 J	1.82	5.28	<0.55	12.8	<0.04	700
0915CB-BC-15	5.72 J	<0.55	<0.204	1.94 J	1.39	3.04 J	0.413 J	9.76	<0.04	<500
0915CB-BC-16	4.66	<0.55	0.152 J	2.58 J	1.75	4.82	<0.55	11.8	<0.04	680
0915CB-BC-17	5.02	<1.89	0.158 J	2.93 J	1.82	4.69 J	<0.63	13.2	<0.04	640
Screening level (SL)	57	150	5.1	390	450	140	6.1	410	0.41	
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).										



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Table 4: Pesticides, PCBs, Phenols, Phthalates & Misc. Extractables

Sample I.D.	Pesticides				Phenol	Phthalate				PCB Aroclors								
	µg/kg (ppb)																	
	4,4'-DDD	4,4'-DDE	4,4'-DDT	Total DDT	3&4 Methyl phenol	phenol	Diethyl phthalate	Di-n-butyl phthalate	Bis(2-ethylhexyl) phthalate	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Aroclor 1268
0915CB-GC-01	<1.0	<0.5	<1.1	ND	79 J	<100	<110	<70	<240	<8.5	<5.7	<24.8	<4.4	<11.8	<2.8	<9.5	<7.1	<4.8
0915CB-GC-02	<0.9	<0.4	<1.0	ND	21 J	<90	21 J	<60	<220	<7.9	<5.3	<23.0	<4.1	<11.0	<2.6	<8.8	<6.6	<4.4
0915CB-GC-03	<0.9	<0.4	<0.9	ND	<90	<90	46 J	<60	<200	<7.2	<4.9	<21.0	<3.7	<10.0	<2.4	<8.0	<6.0	<4.1
0915CB-GC-04	<0.8	<0.4	<0.8	ND	<80	<70	21 J	<50	<180	<5.8	<3.9	<17.1	<3.0	<8.1	<1.9	<6.5	<4.9	<3.3
0915CB-BC-05	<0.9	<0.4	<0.9	ND	<90	<90	61 J	27 J	63 J	<7.0	<4.7	<20.6	<3.6	<9.8	<2.3	<7.8	<5.9	<4.0
0915CB-BC-06	<0.5	<0.2	<0.5	ND	<50	<50	<60	<30	<120	<4.1	<2.7	<11.9	<2.1	<5.7	<1.3	<4.5	<3.4	<2.3
0915CB-BC-07	<0.5	<0.2	<0.5	ND	<50	100 J	<50	<30	<120	<4.0	<2.7	<11.5	<2.0	<5.5	<1.3	<4.4	<3.3	<2.2
0915CB-BC-08	<0.5	<0.2	<0.5	ND	<50	<50	<50	<30	<110	<3.8	<2.5	<11.0	<1.9	<5.2	<1.2	<4.2	<3.2	<2.1
0915CB-BC-09	<0.5	<0.2	<0.5	ND	<50	<50	<50	<30	<110	<3.5	<2.4	<10.2	<1.8	<4.9	<1.2	<3.9	<2.9	<2.0
0915CB-BC-10	<0.5	<0.2	<0.5	ND	<50	<50	<50	<30	<120	<4.0	<2.7	<11.6	<2.1	<5.5	<1.3	<4.4	<3.3	<2.2
0915CB-BC-11	<0.5	<0.2	<0.5	ND	<50	<50	<50	<30	<110	<3.7	<2.5	<10.7	<1.9	<5.1	<1.2	<4.1	<3.1	<2.1
0915CB-BC-12	<0.5	<0.2	<0.5	ND	<50	<50	<50	<30	<110	<3.6	<2.4	<10.6	<1.9	<5.1	<1.2	<4.0	<3.0	<2.0
0915CB-BC-13	<0.5	<0.2	<0.5	ND	<50	<50	<50	<30	<110	<3.5	<2.4	<10.3	<1.8	<4.9	<1.2	<3.9	<3.0	<2.0
0915CB-BC-14	<0.5	<0.2	<0.5	ND	<50	<50	<50	<30	<110	<3.9	<2.6	<11.3	<2.0	<5.4	<1.3	<4.3	<3.2	<2.2
0915CB-BC-15	<0.5	<0.2	<0.5	ND	<50	<50	<50	<30	<110	<3.8	<2.6	<11.1	<2.0	<5.3	<1.2	<4.2	<3.2	<2.1
0915CB-BC-16	<0.5	<0.2	<0.5	ND	<50	<50	<50	<30	<110	<3.7	<2.5	<10.9	<1.9	<5.2	<1.2	<4.2	<3.1	<2.1
0915CB-BC-17	<0.5	<0.2	<0.5	ND	<50	<50	<50	<30	<110	<3.7	<2.5	<10.8	<1.9	<5.1	<1.2	<4.1	<3.1	<2.1
Screen level(SL)	Total 6.9				670		1200	5100	8300	Total 130								
J = Estimated value (reported values are above the MDL, but below the PQL).																		
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).																		

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Table 5: Total and Pore-water Organotin

Sample I.D.	Total (Bulk) Organotin ug/kg				Pore-Water Organotin ug/L			
	Tetra	Tri	Di	Mono	Tetra	Tri	Di	Mono
0915CB-GC-01	<2.9	3.5	<2.9	<2.9	<0.050	<0.020	<0.050	<0.050
0915CB-GC-02	<2.6	<2.6	<2.6	<2.6	<0.056	<0.023	<0.056	<0.056
0915CB-GC-03	<2.3	<2.3	<2.3	<2.3	<0.50	<0.020	<0.050	<0.050
0915CB-GC-04	<2.1	<2.1	<2.1	<2.1	<0.063	<0.025	<0.063	<0.063
0915CB-BC-05	<2.3	<2.3	<2.3	<2.3	<0.50	<0.020	<0.050	<0.050
0915CB-BC-06	<1.4	<1.4	<1.4	<1.4	<0.11	<0.044	<0.11	<0.11
0915CB-BC-07	<1.3	<1.3	<1.3	<1.3	<0.14	<0.056	<0.14	<0.14
0915CB-BC-08	<1.3	<1.3	<1.3	<1.3	<0.25*	<0.10	<0.25*	<0.25*
0915CB-BC-09	<1.3	<1.3	<1.3	<1.3	NA	NA	NA	NA
0915CB-BC-10	<1.3	<1.3	<1.3	<1.3	<0.14	<0.056	<0.14	<0.14
0915CB-BC-11	<1.3	<1.3	<1.3	<1.3	<0.23*	<0.091	<0.23*	<0.23*
0915CB-BC-12	<1.3	<1.3	<1.3	<1.3	<0.14	<0.056	<0.14	<0.14
0915CB-BC-13	<1.3	<1.3	<1.3	<1.3	<0.14	<0.056	<0.14	<0.14
0915CB-BC-14	<1.3	<1.3	<1.3	<1.3	<0.14	<0.056	<0.14	<0.14
0915CB-BC-15	<1.3	<1.3	<1.3	<1.3	<0.28*	<0.12	<0.28*	<0.28*
0915CB-BC-16	<1.3	<1.3	<1.3	<1.3	<0.23*	<0.10	<0.23*	<0.23*
0915CB-BC-17	<1.3	<1.3	<1.3	<1.3	<0.13	<0.050	<0.13	<0.13
Screen level (SL)	73				0.15			
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).								
* Pore water analyses MDLs are elevated due to low volume of pore water in high sand content samples.								
NA = Not Analyzed, sample lost								

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Table 6: Polynuclear Aromatic Hydrocarbons (PAHs) Low Molecular Weight Analytes

Polynuclear Aromatic Hydrocarbons (PAHs) Low Molecular Weight Analytes µg/kg (ppb)								
Sample I.D.	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	2-Methyl naphthalene	Naphthalene	Phen- anthrene	Total Low PAHs
0915CB-GC-01	22 J	<50	27 J	24 J	<70	51 J	<70	124 J
0915CB-GC-02	<80	<50	23 J	23 J	<70	23 J	65 J	134 J
0915CB-GC-03	<70	<40	<60	<90	<60	20 J	38 J	58 J
0915CB-GC-04	<60	<40	<50	<80	<50	15 J	21 J	36 J
0915CB-BC-05	<70	<40	<60	<90	<60	38 J	41 J	79 J
0915CB-BC-06	<40	<30	<40	<50	<40	<40	<40	ND
0915CB-BC-07	<40	<30	<40	<50	<40	<40	<40	ND
0915CB-BC-08	<40	<20	<30	<50	<30	<40	<30	ND
0915CB-BC-09	<40	<20	<30	<50	<30	<40	<30	ND
0915CB-BC-10	<40	<30	<40	<50	<40	<40	<30	ND
0915CB-BC-11	<40	<20	<30	<50	<30	<40	<30	ND
0915CB-BC-12	<40	<20	<30	<50	<30	<40	<30	ND
0915CB-BC-13	<40	<20	<30	<50	<30	<40	<30	ND
0915CB-BC-14	<40	<20	<30	<50	<30	<40	<30	ND
0915CB-BC-15	<40	<20	<30	<50	<30	<40	<30	ND
0915CB-BC-16	<40	<20	<30	<50	<30	<40	<30	ND
0915CB-BC-17	<40	<20	<30	<50	<30	<40	<30	ND
Screen level (SL)	500	560	960	540	670	2100	1500	5200
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit) J = Estimated value (reported values are above the MDL, but below the PQL).								



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Table 6 (cont'd): Polynuclear Aromatic Hydrocarbons (PAHs) High Molecular Weight Analytes

Polynuclear Aromatic Hydrocarbons (PAHs) High Molecular Weight Analytes µg/kg (ppb)										
Sample I.D.	Benzo(a)-anthracene	Benzo-fluoro-anthenes	Benzo-(g,h,i)-perylene	Chrysene	Pyrene	Benzo(a)-pyrene	Indeno-(1,2,3-cd)-pyrene	Dibenz(a,h)anthracene	Fluor-anthene	Total High PAHs
0915CB-GC-01	69 J	77 J	<120	64 J	250 J	32 J	<170	<180	280 J	772 J
0915CB-GC-02	50 J	58 J	<110	81 J	110 J	24 J	<160	<160	110 J	433 J
0915CB-GC-03	17 J	<120	<100	40 J	62 J	<80	<140	<150	61 J	180 J
0915CB-GC-04	<60	<110	<90	<40	25 J	<70	<120	<130	25 J	50 J
0915CB-BC-05	<70	<120	<100	<60	75 J	<80	<140	<150	60 J	215 J
0915CB-BC-06	<40	<70	<60	<40	<100	<50	<90	<90	<90	ND
0915CB-BC-07	<40	<70	<60	<40	<100	<50	<90	<90	<90	ND
0915CB-BC-08	<40	<70	<60	<30	<90	<40	<80	<80	<90	ND
0915CB-BC-09	<40	<70	<60	<30	<90	<40	<80	<80	<90	ND
0915CB-BC-10	<40	<70	<60	<30	<90	<40	<80	<80	<90	ND
0915CB-BC-11	<40	<70	<60	<30	<90	<40	<80	<80	<90	ND
0915CB-BC-12	<40	<70	<60	<30	<90	<40	<80	<80	<90	ND
0915CB-BC-13	<40	<70	<60	<30	<90	<40	<80	<80	<90	ND
0915CB-BC-14	<40	<70	<60	<30	<90	<40	<80	<80	<90	ND
0915CB-BC-15	<40	<70	<60	<30	<90	<40	<80	<80	<90	ND
0915CB-BC-16	<40	<70	<60	<30	<90	<40	<80	<80	<90	ND
0915CB-BC-17	<40	<70	<60	<30	<90	<40	<80	<80	<90	ND
Screen level (SL)	1300	3200	670	1400	2600	1600	600	230	1700	12000
J = Estimated value (reported values are above the MDL, but below the PQL). Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).										



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Figure 1, Coos Bay, Vicinity Map

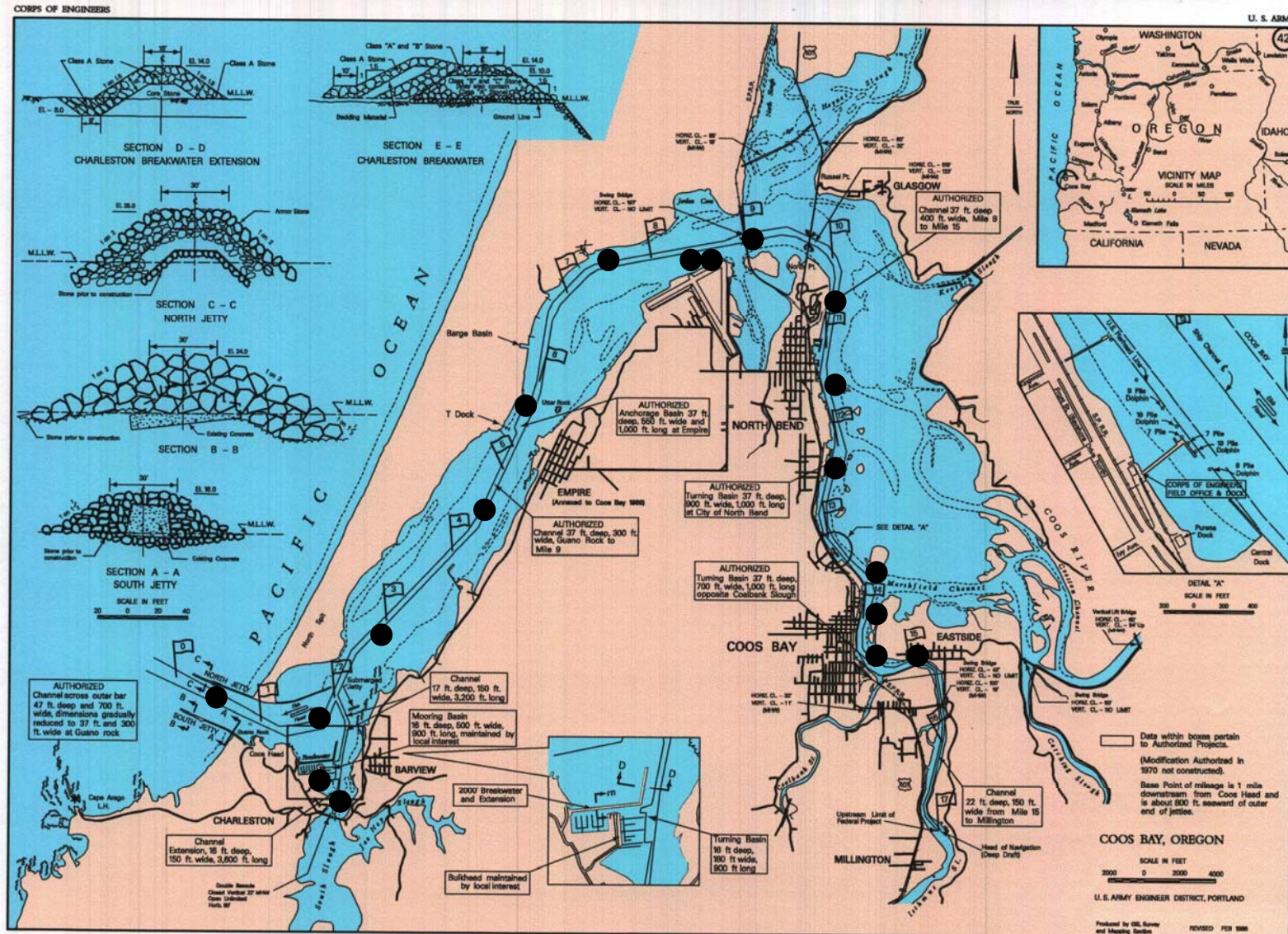
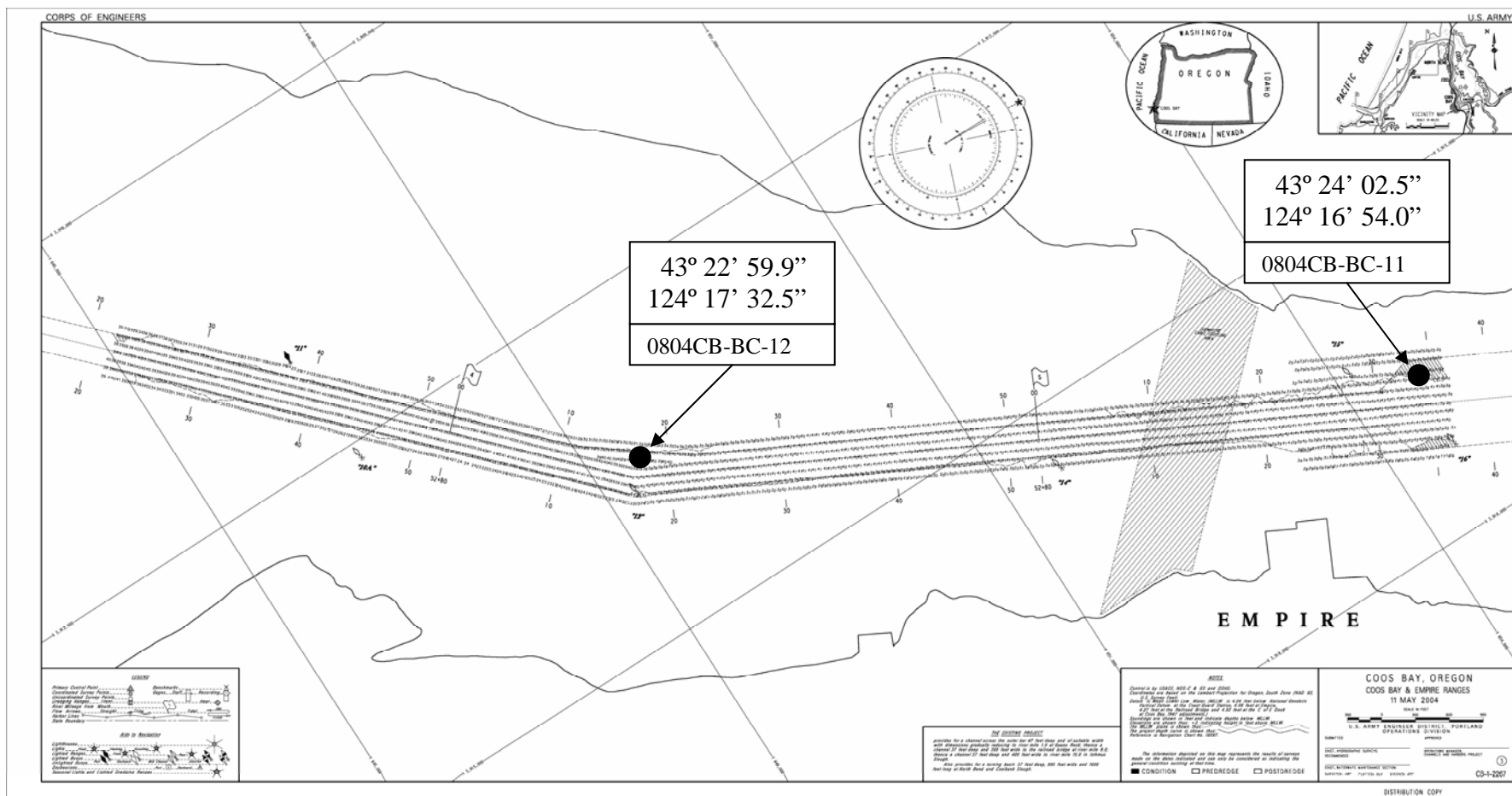


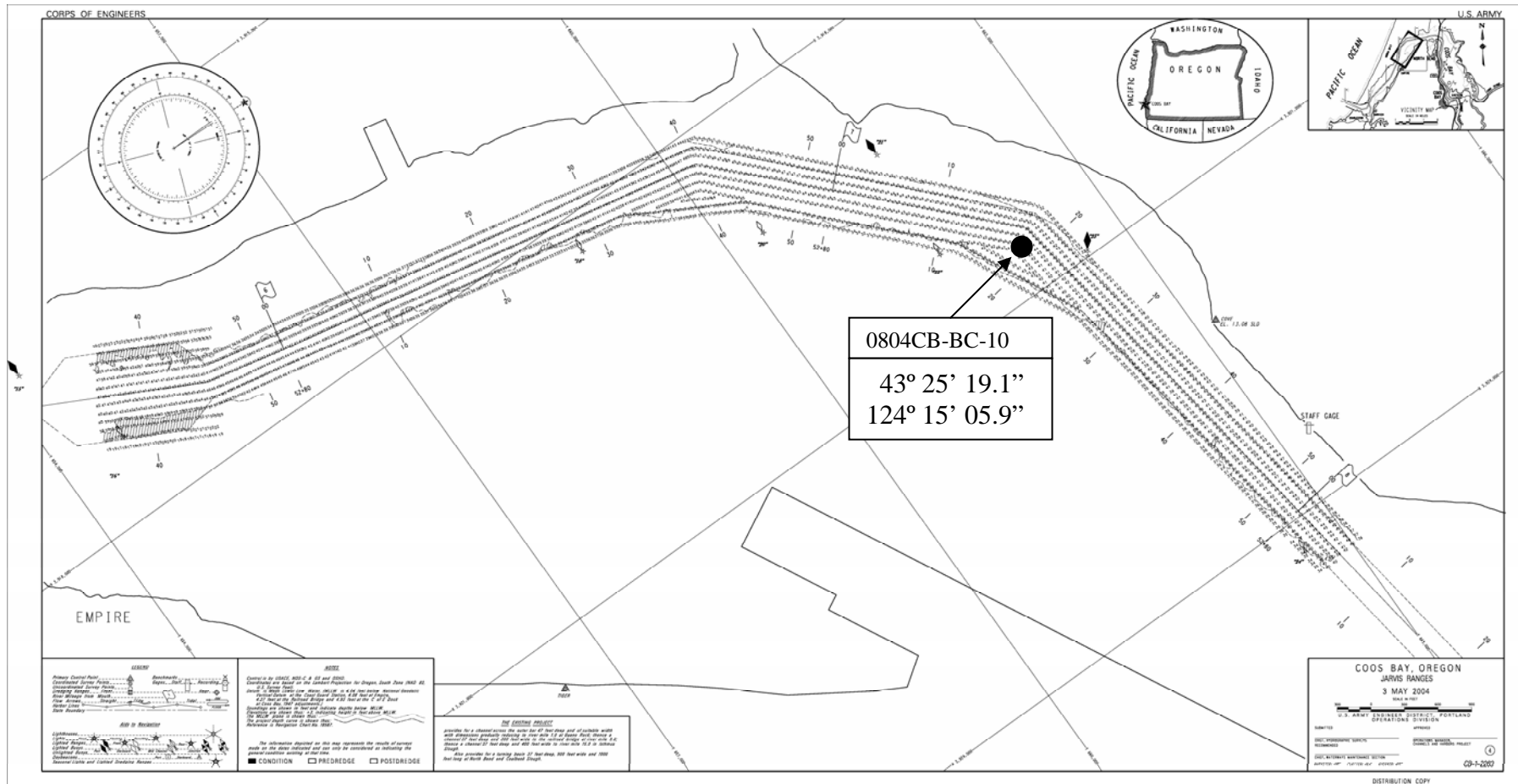


Figure 4: Coos Bay Project, Coos Bay and Empire Ranges



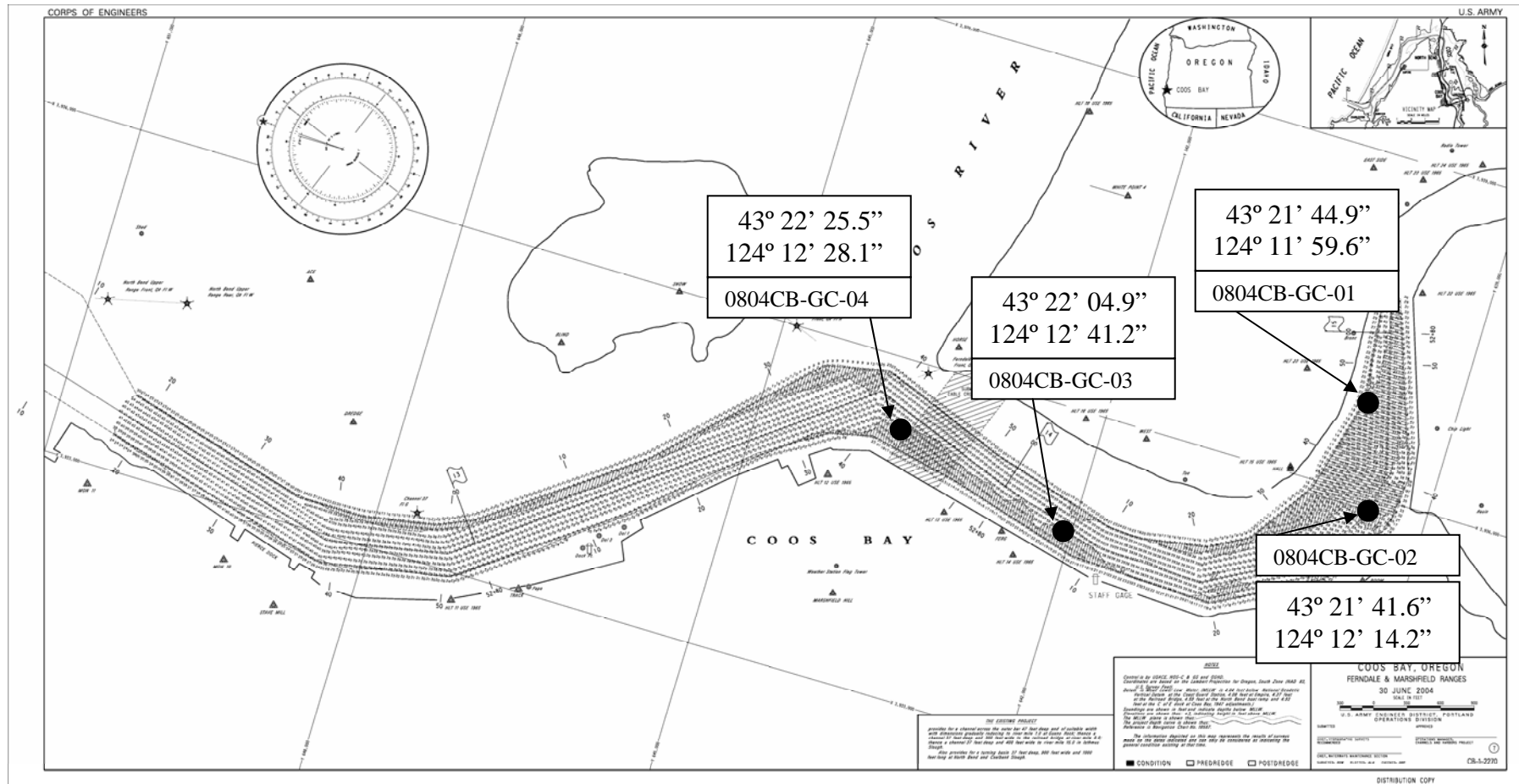
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Figure 5: Coos Bay Project, Jarvis Ranges



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Figure 8: Coos Bay, Ferndale and Marshfield Ranges





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